

### **Remarks/Arguments**

Examiner Chacko Davis is thanked for the thorough Advisory Office Action.

### **In the Claims**

#### **Entry of amendment filed 11 July 2006 in an amendment after final rejection**

Applicant requests entry of the amendment filed 11 July 2006 in an amendment after final rejection. This amendment was entered for purposes of appeal in the advisory action mailed. 2 Aug 2006.

The current amendments assume entry of the 11 July 2006 amendments after final.

#### **Current Amendments**

Parent method claim 1 is amended to include the step of "providing a reticle... ". The reticle limitations are moved from above to the step of "providing a reticle .. ". This amendment only clarifies that the reticle is required for the method. No new matter is added.

Claim 1 is amended to add the word "essentially" ("reticle substrate passing **essentially** all incident light"). For support see Spec. p. 7, L 18.

Claim 1, last line amended to add the word essentially so that ("opaque film blocking light so that **essentially** all incident light is attenuated."). For support see Spec. p. 8, L 14.

Claim 1 is also amended to include the limitations of "said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is **less or more** sensitive to light than said upper photoresist layer;" For support see claim 2 (less sensitive) . See claim 4 for support for "more sensitive".

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Claim 2 is canceled.

Parent method claim 6 is amended to include the step of “providing a reticle...”. The reticle limitations are moved from above to the step of “providing a reticle ..”. This amendment only clarifies that the reticle is required for the method. No new matter is added.

Parent claim 6 is also amended to include the limitations of dependent claim 7. (e.g., less sensitive resist). Claim 6 is also amended to include the limitation of --more sensitive resist—For support see amended claim 1 above. See claim 4.

Claim 6 is amended to add the --dielectric layer- . For support see figure 5A; See Spec. p. 13. L 25 to p. 14, L 2.

Claim 6 step b is amended to add the limitation of the – one step exposure—for support see spec. p. 12. L: 9.

Claim 7 is canceled.

Parent device claim 12, step b is amended to add the 20 to 70% transmittance limitation. For support see spec p. 7, L 21-26.

Parent claim 12 is amended to add the limitations of dependent claims 13 and 16.

Dependent claims 13 and 16 are canceled.

Claim 14 is amended. For support see spec. p. 8 , LL 1-10.

Claim 17 is amended. See claim 1 amendments above. For support see Spec. p. 7, L 18. For support see Spec. p. 8, L 14.

Parent device claim 19 is amended to add the limitations of dependent claim 20.

Dependent claim 20 is canceled.

No new matter is added.

**Non-limiting overview on an example embodiment**

Amended method claims 1 and 6 have the combination of least 2 novel elements :

- (A) Mask with 20 to 70% partially transiting **180 degree phase shift** film; and
- (B) Upper resist 20 (more light sensitive) and lower resist layer 24 .

See applicants' figure 1 below that shows the (A) partially transmitting phase shift film 46 transmitting approximately 20% to 70% of incident light with **180 degree shift**. See Spec. p. 7, LL 21-25. Also see the developed (B) **lower resist 20 and upper resist layer 24**.

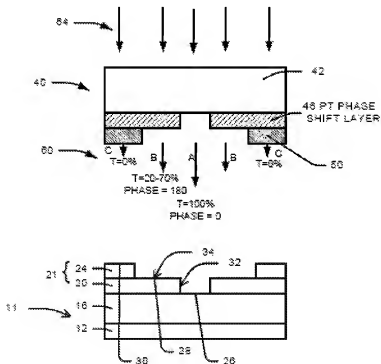


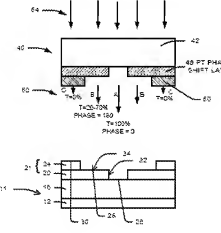
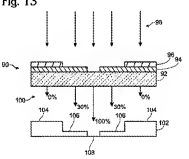
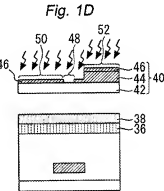
FIGURE 1

Claims 1 and 6 are non-obvious over cited references Nguyen and Matsunuma for at least the following reasons:

- Nguyen's **90 degree phase shift mask** teaches against claim 1's partially transiting **180 degree phase shift mask**.
- Nugyen teaches only one resist layer in contrast to claim 1 & 6's two resist layers.
- Matsunuma's **zero/NO phase shift mask** teaches against claim 1's **180 degree phase shift film**.
- **Improper combination** of Nugyen and Matsunuma
  - Nugyen and Matsunuma solve different problems. Matsunuma solves the problem of accurately controlling resist film thickness **for a 0 zero non-phase shifted mask**. col. 6, L 5-7. This is not a problem in either Nugyen or applicant. Possibly, not a problem with phase shift masks. There is no motivation to combine references. This reasoning can only be applied with hindsight.
- **Synergistic combination** - The Claims 1 and 6 combination of (A) 180 degree phase mask and (b) two different light sensitivity resist layers has a **synergistic effect**. The applicants' method 180 degrees has been found by the inventors to enable the definition of smaller features. This is because destructive interference of light of opposite phases (0 and 180 degree ) helps to cancel out noise and improve image contrast. This combination enables enhanced feature resolution (e.g. formation of a smaller via hole in a dual damascene process). See specification p. 15, LL 9 -17)

The table below give an non-limiting overview of the difference between the claims and the cited references.

Table: Non-obvious differences between claims 1 & 6 and cited references.

<b><u>Applicant's</u></b> <b><u>Claim 1 and 6 limitations</u></b>	<b><u>US 5,936,707 (Nguyen et al)</u></b>	<b><u>US 6,482,554 (Matsunuma).</u></b>
<p>(A) Mask with 20 to 70% partially transiting <b>180 degree phase shift film</b></p> <p>See figure 1.</p>	<p><b>Teaches <u>against</u> 180 shift mask</b> – teaches a <b>90 degree phase shift</b> (Col. 7, lines 57-61). ** Does not teach applicant's 180 PSM mask.</p>	<p><b>Teaches <u>against</u> 180 shift mask</b> – Matsunuma mask 40 has <b>0 phase shift (non-phase shifted)</b>. see col. 3 l62 to col. 3. L 35; figure 1D.</p>
<p>(B) Upper resist 20 (more light sensitive) and lower resist layer 24</p>	<p><b>Teaches <u>against</u></b> – only teaches a single resist layer 102 –figs 6, 7 &amp; 13; col 9., L39-65.</p>	<p>– 2 resists 36 38 with <b>0 degree non-phase shift exposure.</b></p>
 <p>FIGURE 1</p>	 <p>Fig. 13</p> <p>Nguyen – 90 degree shift mask with <b>single</b> resist layer 102</p>	 <p>Fig. 1D</p> <p>Matsunuma teaches 0 degree phase shift mask 40</p>

Furthermore, Claims 5 and 6 comprise a non-obvious single etch of the photoresist and dielectric layer to form a dual damascene shaped opening.

**CLAIM REJECTIONS:**

The discussion below of claim rejections is organized in the order of the claims (e.g, Method claims then device claims).

**The rejection of Claims 1, 5-6, and 11-20, under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,936,707 (Nguyen et al).**

And

**Rejection of Claims 2-4, and 7-10, and 21 under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,936,707 (Nguyen et al) in view of U. S. Patent No. 6,482,554 (Matsunuma).**

The rejection of the claims under 35 U.S.C. 102(b) 103(a) as being unpatentable over U. S. Patent No. 5,936,707 (Nguyen et al) in view of U. S. Patent No. 6,482,554 (Matsunuma) is acknowledged. Reconsideration and withdrawal of the rejection is respectfully requested in view of the comments.

The rejection of claims 1, 5-6, and 11-20, under 35 U.S.C. 102(b) as being anticipated by U. S. Patent No. 5,936,707 (Nguyen et al) is acknowledged. Reconsideration and withdrawal of the rejection is respectfully requested in view of the amendments.

**Method parent Claims 1 and 6 are amended to include the limitation of the two different light sensitivity photoresist layers**

Method parent Claims 1 and 6 are amended to include the limitation of dependent claims 2 and 7 (the two photoresist layers).

Amended claim 1 states: (emphasis added)

1. A method for forming a photoresist pattern on a prescribed film, said photoresist pattern having a multi-level profile formed from exposure to light transmitted through a reticle having a multi-level profile,  
the method comprising the steps of:

providing a reticle; the reticle comprises one or more films overlying a reticle substrate to partially transmit and shift the phase of incident light, the reticle substrate passing essentially all incident light and the **partially transmitting phase shift film** transmitting approximately between **20% to 70%** of incident light and **shifting the phase about 180 degrees** in transmission through the partially transmitting film, and an opaque film overlying sections of the partially transmitting film, the opaque film blocking light so that essentially all incident light is attenuated;

a) exposing a light sensitive photoresist film, having a predetermined thickness, to light transmitted through the reticle for a predetermined amount of time, with light being transmitted through the reticle substrate exposing a first photoresist area to a first dosage,

with light being transmitted through the partially transmitting film exposing a second photoresist area to a second intermediate dosage, and

with light being transmitted through the remaining opaque film exposing a third photoresist area to a third dosage;

**said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less or more sensitive to light than said upper photoresist layer;**  
and

b) developing the photoresist film exposed in step (a) to form a photoresist profile having an opening in the first photoresist area, the photoresist profile having the photoresist predetermined thickness in the third photoresist area, and the photoresist profile having an intermediate thickness, between the predetermined thickness and zero, in the second photoresist area,

whereby light introduced to the reticle transmits at least three intensities of light to transform the photoresist film into a profile of at least two thicknesses and an opening.

Parent claims 1, and 6 differentiate over and is non-obvious over US 5,936,707(Nguyen et al. ) and **6,482,554 (Matsunuma)**. or at least the following reasons.

Applicants' claim 1 states that the partially transmitting phase shift film" is a 180 degree phase shift layer.

Also see applicants' figure 1 below that shows the partially transmitting phase shift film 46 transmitting approximately 20% to 70% of incident light with 180 degree shift. See Spec. p. 7, LL 21-25. Also see the lower resist 20 and upper resist layer 24.

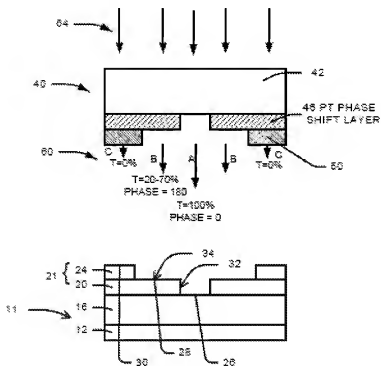


FIGURE 1

Nguyen, in contrast, teaches directly against the applicant's **180 degree** "partially transmitting phase shift film "by Nguyen specifically teaching a **90 degree phase shift layer**. See Nguyen. Claim 1, Line 13, , Nguyen Col. 7, Line 38, see col. 7, L 30 to 38. Nguyen teaches against changing Nguyen's 90 degree phase shift. See col. 7, L 57-64.



NGUYEN teaches a 90 degree phase shift layer not a 180 phase shift.

Nguyen col 7, lines 30 to 38 describes Nguyen's second transmission level film 54 as shown below: (emphasis added).

Second transmission level film 54 retards the phase of light in a predetermined number of degrees whereby the phase difference between reticle transmission level films improves the resolution in transmitted light intensities to reduce constructive interference between adjacently illuminated areas of photoresist. **It is a feature of the invention that second transmission level film 54 retards the phase of transmitted light approximately 90°.**

Nguyen, col. 7, line 38 explicitly states the **"second transmission level film 54 retards the phase of transmitted light approximately 90°."** This contrasts with applicant's claims 1, and 6's **180 degree Phase Shift layer.**

**NGUYEN teaches against using a 180 degree phase shift layer**

NGUYEN explicitly teaches against using applicant's claim 1 and 6 180 degree phase shift layer.

Nguyen col. 7, L 57-61 state: (emphasis added)

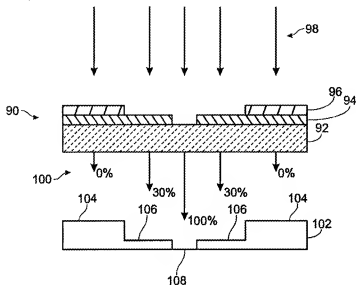
**The use of 180° phase shifting film has been found to cause excess cancellation in the area of the resist surrounding the via.** Optimum results are obtained when using only partial cancellation of diffracted light. A partially transmitting film having a phase shift of 90°, and a transmission intensity of 30% (attenuating 70% of incident light) is found to be effective.

One of the applicants' further notes:

Referring to Figure 13 of Nguyen, at the edge where the clear area covered with a phase shift layer 94 abuts an area of clear glass without a phase-shifter, interference between the light diffracted from both regions causes a dark line to be printed at the boundary. This is because the resultant interference waveform around the boundary is too weak to sensitize the photoresist.

Nguyen figure 13 below.

Fig. 13



Therefore, Nguyen uses a partially transmitting film having a phase shift of 90 degrees so that there is only partial cancellation of diffracted light. In this way, the resultant interference waveform around the boundary has a sufficiently high intensity.

**Claim 1 and 6 have non-obvious upper and lower photoresist layers**

In contrast to Nguyen's method, applicant's claim 1 and 6 embodiments use a photoresist film comprised of a lower and upper resist layer, the upper resist layer being more sensitive to light. This enables a partially transmitting film having a phase shift of 180 degrees to be used since the upper resist layer can be selected to be of a higher sensitivity to light.

As mentioned on Specification page 7, LL 25-26 and p. 15, LL 2 17, a partially transmitting film having a phase shift of 180 degrees has been found by the inventors to enable the definition of smaller features. This is because destructive interference of light of opposite phases (0 and 180 shift regions) helps to cancel out noise and improve image contrast.

Therefore, the claimed 1 and 6 combination of using a mask with a

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partially transmitting film of 180 degrees phase shift and two level photoresist of 2 different light sensitivities has a synergistic effect. This combination enables enhanced feature resolution (e.g. formation of a smaller via hole in a dual damascene process).

This is more than a mere collocation of features. Therefore claim 1 and 6 are not obvious over Nguyen, Matsunuma and the combination thereof.

**The combination of U. S. Patent No. 5,936,707 (Nguyen et al) and U. S. Patent No. 6,482,554 (Matsunuma). is improper**

The combination of U. S. Patent No. 5,936,707 (Nguyen et al) and U. S. Patent No. 6,482,554 (Matsunuma) is improper for many reasons.

First, there is no motivation to combine U. S. Patent No. 5,936,707 (Nguyen et al) and U. S. Patent No. 6,482,554 (Matsunuma).

Furthermore, Matsunuma (no phase shift mask ) teaches against using Nguyen et al.'s 90 degree partially transmitted PSM and applicant's 180 degree partially transmitted PSM. Matsunuma figures 4A to 4F, col. 9A to 9G; col. 6, L 26 to Col. 7, L 7; teach specifically a non-phase shift mask. No where in the patent does Matsunuma mention "phase" or "phase shift". The operations of a phase shift and non-shift masks are different and the photoresists have different requirements.

For these reasons the combination of Matsunuma and Nguyen et al is improper and all claims are non-obvious.

**The previous Office action's reasons for combination are not convincing**

The final office action states:

Therefore, it would be obvious to a skilled artisan to modify Nguyen by employing the method of using two layers of photoresist as suggested by Matsunuma **because** Matsunuma, in col 5, lines 45-51, discloses that the dual layers of photoresist can be replaced with a thick single layer of photoresist, and vice versa, and Matsunuma, in col 6, lines 5-7, discloses **that using a first photoresist film and a second photoresist film of differing**

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**sensitivities makes it possible to accurately control the film thickness.**

However, this reason is not convincing and does not make a prima facia showing.

First, Matsunuma only discusses non-phase shifted mask and therefore the Matsunuma, ( col 6, lines 5-7,) ability to “accurately control the film thickness” applies to non-phase shifted processes. Phase shifted and non-phase shifted processes have entirely different operation principles. No where does Matsunuma suggest it can be applied to phase shifted processes.

Applicant is solving the problem of forming small dimension via holes in dual damascene structures by using a 180 phase shift mask and two resist layer. See spec. p, LL 9 -17.

There is no suggestion in either Nguyen or Matsunuma to solve this problem. There is no teaching in Nguyen or Matsunuma to combine. Each reference is complete. Furthermore, if it was so obvious, Nguyen or Matsunuma would have done so already.

Nguyen and Matsunuma solve different problems. Matsunuma attempts to solve a problem identified only by Matsunuma (Matsunuma, in col 6, lines 5-7, e.g., control thickness of photoresist). However, Nguyen does not have a film thickness problem. Nguyen does not attempt to solve this Matsunuma photoresist thickness problem or any problem remotely related. See entire Nguyen patent.

Therefore claims 1 and 6 are non-obvious over the cited references.

**Claim 2 is canceled**

**Claim 3 is non-obvious**

The final office action pages 4 and 5 states (for the rejection of claims 2-4, and 7-10)

Matsunuma, in col 3, lines 29-60, in col 4, lines 5-44, discloses that the photoresist layer comprises a first photoresist film of low sensitivity and a second photoresist film, formed on the first photoresist film, of high sensitivity greater than that of the first photoresist film; and that the sensitivity of the first photoresist film is adjusted such that the first photoresist film and the second photoresist film is completely exposed through the first transmittance part (transparent portion of the mask substrate), the second intensity of light from the second transmittance part only sensitizes the second photoresist film and not the lower sensitive first photoresist film, and the third intensity of light of the third transmittance part (opaque region) does not sensitize neither the first photoresist film nor the second photoresist film.

The cited section of Matsunuma, do not disclose or suggest the following claim 3 limitation: "said lower photoresist layer is less sensitive to light than said upper photoresist layer between about 5 and 10%."

**Claim 4 is non-obvious**

Claim 4 depends from non-obvious claim 1. As stated above, the combination of references is improper and can only be done with the benefit of hindsight.

**Claim 5 is non-obvious over the cited references**

**Claim 5 states:**

5. (ORIGINAL) The method of claim 1, which further includes etching in a single step, said photoresist film and said a dielectric layer under said photoresist film to form a dual damascene shaped opening in said dielectric layer;  
**said photoresist film and said dielectric layer have about the same etch rate.**

Applicants' claim 5 depends from not anticipated and non-obvious claim 1 and is therefore not anticipated.

Furthermore, the previous office action, page 3 states:

Nguyen, in col 2, lines 66-67, in col 4, lines 35-38, discloses that dual damascene structure can be formed in the dielectric under layer in a

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single etching step such that the dielectric material under layer is etched at the same rate as the overlying multi-level photoresist (claim 5).

However, the cited paragraphs do not meet applicant's claim 5 limitations.

First, Nguyen et al. does not suggest claim 5's limitations.

The first cite, Nguyen, in col 2, lines 66-67, is in the prior art section, pertains to a publication. Nguyen does not appear state that this invention uses this method. See entire Nguyen specification and claims.

The second cite, col. 4, lines 35-38, does not meet applicant's claim 5.

Nguyen col. 4, lines 35-38, states:

It would be advantageous to combine the light intensity attenuation characteristics of a half- tone film to create photoresist masks with a plurality of thicknesses, with phase shifting characteristics of a half-tone film to create sharp features and to reduce errors caused by diffraction.

This does not meet applicant's claim 5 because the cite does not mention a photoresist layer with the **same etch rate** of the dielectric material.

**B) The final office action p. 6 states:**

B) Applicants argue that Nguyen does not disclose that the photoresist layer and the dielectric layer have the same etch rate. Nguyen, in col 6, lines 58-64, and in figures 4-5, discloses an etch step wherein the photoresist film pattern 62, and the dielectric film 54 are etched during the second etch (one etch rate, removed exposed portions of the dielectric at 63, and photoresist pattern 62, i.e., both resist and dielectric material has the same etch rate) resulting in the etching of the photoresist pattern (completely removed) 62, and corresponding removal of the exposed dielectric material (exposed portion, reference 63), resulting in the structure of figure 5, i.e., the masked portion of the dielectric was not etched at the second etch

This section appear to refer to the rejection of e.g., claim 5 and 21 which states:

5. (CURRENTLY AMENDED) The method of claim 1, which further includes etching in a single step, said photoresist film and said a dielectric layer under said photoresist film to form a dual damascene shaped opening in said dielectric layer;  
said photoresist film and said dielectric layer have about the same etch rate.

Claim 5 relates to a method using the claim 1 reticle (see claim 1, lines 2 to 11 ) (with a partially transmitting Phase shift film with a 180 degree shift) to expose a photoresist layer and form a photoresist profile over a dielectric layer and (e.g., Semiconductor) substrate. See spec. p. 13 L 22 to p. 14 L27; figures 5A to 5D. See especially P. 14. L 4-5.

In contrast, the Nguyen section cited in the Office Action, col 6, lines 58-64, and figures 4-5, show Nguyen's **method to make a reticle, not a method to use the reticle** to expose photoresist and etch holes in an underlying dielectric layer. Importantly, Nguyen, in col 6, lines 58-64, and in figures 4-5, does not disclose nor suggest using the applicant's claimed reticle to expose the resist shown in figures 4-5. Nguyen, in col. 6, lines 58-64, and in figures 4-5 is merely showing a method to make Nguyen's 90 degree shift reticle.

Matsunuma teaches away from claim 5's resist and dielectric layer having about equal etch rate.

Matsunuma col. 6, LL 11 to 17 , teaches that it is used to have different etch rates between the two resist layer.

Therefore claim 5 is non-obvious over the combined references.

#### **Parent Claim 6 is non-oblivious**

As discussed above with respect to claim 1, parent claim 6 is non-obvious. Claim 6 contains additional non-obvious limitations as in claim 1.

**Claim 7 is canceled.**

**Claim 8 is non-obvious**

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Claim 8 depends from non-obvious claim 6. As stated above, the combination of references is improper and can only be done with the benefit of hindsight.

**Claim 9 is non-obvious**

**Claim 9 states:**

9. (ORIGINAL) The method of claim 6 wherein said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer by between about 5 and 10%.

Claim 9 depends from non-obvious claim 6. As stated above, the combination of references is improper and can only be done with the benefit of hindsight.

Claim 9 claims a difference

**Claim 10 is non-obvious**

**Claim 10 states:**

10. (CURRENTLY AMENDED) The method of claim 6 which further includes: said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer by between about 5 and 10%; and transferring said pattern in said photoresist film by an etch into the surface of said substrate in a single etch step; the etch rate of said photoresist film and said dielectric layer substrate are about equal.

Claim 10 contains similar limitation as does claim 5. The instant office action makes the same arguments for the non-obviousness of claims 5 and 10. Claim 10 is non-obvious for the same reasons give above for claim 5.

Furthermore, Reference Matsunuma teaches against claim 10's limitation of the "the etch rate of said photoresist film and said substrate are about equal." Matsunuma, col. 6, LL 10 to 17 teaches that the first and second photoresist



layer have different etch characteristic (e.g., etch rates). See figures 5A thru 5D and accompanying text (showing the etch rate differences between the 1st resist layer, the second resist layer and the dielectric layer.

Therefore, claim 10 is submitted to be allowable over the cited references and reconsideration and allowance are respectfully solicited.

(PREVIOUSLY PRESENTED) claim 21 is non-obvious over the combination of references

claim 21 states.

21. The method of claim 1 which further includes  
said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer;  
etching in a single step, said light sensitive photoresist film and said a dielectric layer under said photoresist film to form a dual damascene shaped opening in said dielectric layer;  
said lower photoresist layer, said upper photoresist layer and said dielectric layer have about the same etch rate.

Reference Matsunuma teaches against claim 21. Matsunuma, col. 6, LL 10 to 17 teaches that the first and second photoresist layer have different etch characteristic (e.g., etch rates). See figures 5A thru 5D and accompanying text (showing the etch rate differences between the 1st resist layer, the second resist layer and the dielectric layer. )

Therefore, claim 21 is non-obvious.

**Rejection of device claims 12, 14 15 and 17 18 and 19 21 under 35 U.S.C. 102 as being unpatentable over U. S. Patent No. 5,936,707 (Nguyen et al)**

The rejection of device claims 12, 14 15 and 17 18 and 19 21 under 35 U.S.C. 102 as being unpatentable over U. S. Patent No. 5,936,707 (Nguyen et al) is

acknowledged. Reconsideration and withdrawal of the rejection is respectfully requested in view of the amendments.

The parent device claims teach a novel mask with a 20 to 70% partially transiting **180 degree phase shift** film. See parent claims 12, 17 and 19.

Nguyen, in contrast, teaches directly against the applicant's **180 degree** "partially transmitting phase shift film "by Nguyen specifically teaching a **90 degree phase shift layer**. See Claim 1, Line 13, , Nguyen Col. 7, Line 38, see col. 7, L 30 to 38; Nguyen teaches against changing Nguyen's 90 degree phase shift. See Col. 7, L 57-64.

The final Office Action dated May 7, 2006, page 6, Line 1, posits that Nguyen

"Nguyen, in col 4, lines 24-43, discloses using a half-tone film that transmits light with a phase shift of about 180".

However, Nguyen, in col. 4, lines 4-30, in the prior art section discusses prior art Levenson and Kobayashi, states (emphasis added):

The above disclosures reveal a reticle constructed of a transparent substrate made of a quartz material to transmit substantially all incident light. The reticle is constructed with a half-tone, or phase shifting film over the substrate to shift the phase of transmitted light. Over the half-tone layer is an opaque film to substantially block transmitted light. Through the use of phase shifting, to produce destructive interference, these reticles produce light at substantially two intensities, 100% intensity and 0% intensity, to form a single-level photoresist mask as is well known in the art. Alternately, it can be said that the reticle produces light at a single intensity (100% transmission), and otherwise blocks (0% transmission) the light. Phase shifting performed with the single level photoresist mask is for the purpose of more clearly defining features, such as vias, and to reduce the effects of diffraction. Typically, conventional half-tone material is chosen with regard to its phase shifting characteristics, as opposed to its light attenuation characteristics. Therefore, the half-tone films in the phase shifting reticles are chosen to phase shift transmitted light **180°** while providing substantially no attenuation, as **disclosed in the Levenson article**. Alternately, halftone films are chosen to phase shift transmitted light **180°** while substantially attenuating the intensity of transmitted light as **disclosed in Kobayashi, et al.**

As shown above, when read in context, Nguyen, in col. 4, lines 24 -30, In The Prior Art Section, mere states **that other references** (NOT NGUYEN'S INVENTION) have half tone layer with **180 phase shifts with no or full (0 or 100%) attenuation**. See bolded text above. These sentences pertain only to "the "Ievenson article" and to "Kobayashi et al." See col. 4, L 24-30; See last 2 sentences above. NOTE THAT this section does not disclose the applicant's claim 1's, ""partially transmitting phase shift film transmitting approximately **20% to 70%** of incident light ".

The Applicant's representative respectfully requests that the examiner point out and "quote" the specific words in Nguyen that support that Nguyen's invention is a 180 degree shift layer.

Furthermore, Nguyen, in col 4, lines 31-43, states (emphasis added):

It would be advantageous to utilize the intensity attenuation characteristics of half-tone films in the production of photoresist masks.

It would also be advantageous to use the intensity attenuation characteristics of half-tone films to make photoresist masks, or patterns, having multi-levels to perform etching into IC substrate material to a plurality of depths.

It would be advantageous to combine the light intensity attenuation characteristics of a half-tone film to create photoresist masks with a plurality of thicknesses, with phase shifting characteristics of a half-tone film to create sharp features and to reduce errors caused by diffraction.

Accordingly, a reticle is provided through which incident light is passed to define predetermined areas of illumination on a light sensitive photoresist surface. The reticle comprises a first transmission level film producing transmitted light of a first intensity, a second transmission level film producing transmitted light of a second intensity greater than the first intensity, and a third transmission level film producing transmitted light of a third intensity greater than the second intensity.

Second transmission level film transmits more than approximately 10%, but less than approximately 90%, of incident light, whereby the attenuation characteristics of the second transmission level film are approximately mid-way between the first and third transmission level film attenuation characteristics, such that the reticle, when directed to a light sensitive surface, forms at least three distinctive intensities on the illuminated areas of photoresist.

As shown above, Nguyen lines 31 – 43, discloses that Nguyen et al. invention is a half tone mask, but does not state what phase shift is used.

Furthermore, in the Nguyen's spec col 7, lines 30 to 38 and Nguyen's claims 1, 11 and 19, Nguyen states the Nguyen's second transmission film 54 is a **90 degree (NOT 180) phase shift layer**.

The instant office action appear to be interpreting or arguing that Nguyen's prior art section's discussion (col. 4, lines 22 -29) of 0 or full attenuated 180 phase shift layers (which Nguyen is trying to improve upon by using Nguyen's second transmission layer 54 90 degree phase shift layer 54 Nguyen col. 7, line 35) is actually discussing Nguyen's invention. However, no where in Nguyen col. 4, lines 22 -29 does Nguyen discuss his invention, only prior art.

NGUYEN teaches a 90 degree phase shift layer not a 180 phase shift.

Nguyen col 7, lines 30 to 38 describes Nguyen's second transmission level film 54 as shown below: (emphasis added).

Second transmission level film 54 retards the phase of light in a predetermined number of degrees whereby the phase difference between reticle transmission level films improves the resolution in transmitted light intensities to reduce constructive interference between adjacently illuminated areas of photoresist. **It is a feature of the invention that second transmission level film 54 retards the phase of transmitted light approximately 90°.**

Nguyen, col. 7, line 38 explicitly states the **"second transmission level film 54 retards the phase of transmitted light approximately 90°.**" This contrasts with applicant's claims 1, 6 and 12's **180 degree Phase Shift layer**.

For this reason and other reasons not elaborated on, device claims **12, 14 15 and 17 18 and 19 21** is not anticipated by Nguyen. The claims are non-obvious over Nguyen since Nguyen teaches away from the claimed 180 degree partially transmitting phase shift layer.

**PENDING CLAIMS**

It is believed that all the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper. and the amendment of any claim does not necessarily signify concession of the unpatentability of the claim prior to its amendment.

**CONCLUSION**

In conclusion, reconsideration and withdrawal of the rejections are respectfully requested. Allowance of all claims is requested. Issuance of the application is requested.

It is requested that the Examiner telephone the undersigned attorney at (215) 670-2455 should there be anyway that we could help to place this Application in condition for Allowance.

**Charge to Deposit Account**

The Commissioner is hereby authorized to apply any fees or credits in this case, which are not already covered by check or credit card, to Deposit Account No. 502018 referencing this attorney docket. The Commissioner is also authorized to charge any additional fee under 37 CFR §1.16 and 1.17 to this Deposit Account.

Respectfully submitted,

/William J. Stoffel REG # 39,390/

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